



# **POSSIBLE**

## **Effects of Changing Climate Patterns on Reptile and Amphibian Populations in SC**

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I'LL FOCUS ON THE COASTAL PLAIN BECAUSE THAT'S WHAT I AM  
MOST FAMILIAR WITH

# **AMPHIBIANS ARE FIRST RESPONDERS**





## **Salamander Populations and Biomass in the Hubbard Brook Experimental Forest, New Hampshire**

**Thomas M. Burton and Gene M. Likens**

There were about **2,950 salamanders per ha (1,770 g/ha wet wt.)** in the Hubbard Brook Experimental Forest in New Hampshire. The terrestrial species, *Plethodon cinereus*, accounted for about 93.5% of the total biomass while the streamside species, *Desmognathus fuscus*, *Eurycea bislineata* and *Gyrinophilus porphyriticus*, accounted for the remaining 6.5%. *Notophthalmus viridescens* was present, but was rare and insignificant in the biomass calculations. The population size of salamanders at Hubbard Brook appears to be stable. **The biomass of salamanders is about twice that of birds during the bird's peak (breeding) season and is about equal to the biomass of small mammals**

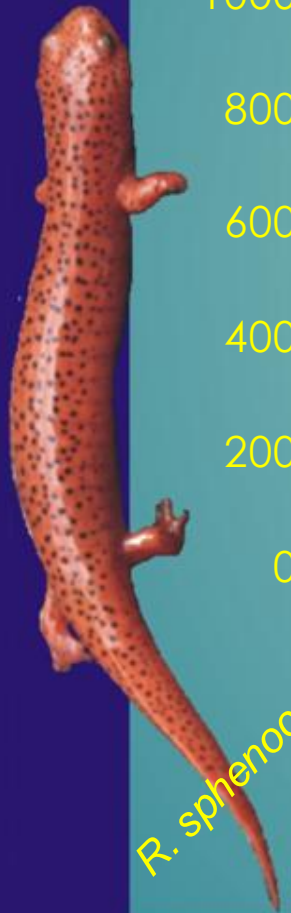


**4 POUNDS OF SALAMANDER BIOMASS PER ACRE  
HUBBARD BROOK = 7660 ACRES  
30640 POUNDS OF SALAMANDERS  
15 TONS OR 13.9 METRIC TONS**





# 2003 EBAY Amphibian Biomass





# Potential Impacts of Climate Change on Ecosystems

Changes in the Timing of Seasonal Life-Cycle Events

Range Shifts

Food Web Disruptions

Threshold Effects

Pathogens, Parasites, and Disease

Extinction Risks



Source: EPA





## Potential Impacts of Climate Change on Ecosystems

Models do suggest that rainfall will arrive in heavier downpours with increased dry periods between storms.

Sea level rise along the Southeast coast will likely erode wetlands and coastal shorelines. Low-lying areas would be flooded more frequently.

Higher temperatures increase evaporation and water loss from plants. Projected increases in temperature will likely increase the frequency, duration, and intensity of droughts in the area. [\[3\]](#)

If the region increases groundwater pumping to offset water shortfalls, then aquifers will be further depleted. In the long term, the depletion of ground water supplies would place additional strain on surface water resources. [\[3\]](#)





## EXAMPLE 1 – TEMPORARY, ISOLATED WETLANDS

CAROLINA BAYS, VERNAL POOLS, FLATWOODS PONDS, SWALE PONDS, HIGH PONDS ETC.

### TYPICAL CHARACTERISTICS

PERCHED WATER TABLES

NOT CONNECTED TO SURFACE STREAMS

PULSED HYDROLOGY DRIVEN BY RAINFALL CYCLES

DETRITUS BASED FOOD WEBS

PREDATORY FISH ARE TYPICALLY ABSENT

### VARIABLE CHARACTERISTICS

A VARIETY OF PLANT COMMUNITIES POSSIBLE

BASIN SIZE AND DEPTH

PERCHING MECHANISM

LOCATION IN LANDSCAPE



# Typical Year ... but there are no typical years



LATE SUMMER-FALL



WINTER-EARLY SUMMER



LATE SUMMER-FALL

**PONDS MAY HOLD WATER FOR MULTIPLE YEARS OR BE DRY FOR MULTIPLE YEARS DEPENDING UPON RAINFALL PATTERNS**







## **AMPHIBIANS AND “PONDS” IN THE COASTAL PLAIN OF SOUTH CAROLINA**

**49 SPECIES OF AMPHIBIANS OCCUR IN SC COASTAL PLAIN**

**33 OF THESE SPECIES (69%) USE PONDS FOR BREEDING HABITAT (SOME LIVE IN THE PONDS YEAR ROUND)**

**11 OF THESE SPECIES ARE ENDEMIC TO, OR STRONGLY SELECTIVE OF PONDS AS BREEDING SITES**

**3 OF THESE SPECIES ARE PROTECTED UNDER STATE OR FEDERAL LAW**

**FLATWOODS SALAMANDER-FEDERALLY THREATENED**

**GOPHER FROG-STATE ENDANGERED**

**DWARF SIREN-STATE THREATENED**





**BARKING TREEFROG**



**OAK TOAD**



**CAROLINA GOPHER FROG**



**SPADEFOOT TOAD**



**ORNATE CHORUS FROG**







**MABEE'S SALAMANDER (LARVA)**



**DWARF SIREN**



**MOLE SALAMANDER**



**FLATWOODS SALAMANDER**  
DIRK STEVENSON



**MARbled SALAMANDER**





**SPOTTED TURTLE**



**GLOSSY CRAYFISH SNAKE**



**CHICKEN TURTLE**



**BANDED WATERSNAKE**



**MUD SNAKE**



**EASTERN MUD TURTLE**



**BLACK SWAMP SNAKE**





**“POND” HYDROLOGY IS COMPLICATED! BUT RAINFALL IS KEY**

**AVERAGE DATE OF FILLING  
HYDROPERIOD (LENGTH OF TIME POND HOLDS WATER)**

**EXTREMES**

**EL NINO ... EXCESSIVE RAIN FILLS PONDS HEY EXPERIENCE AN  
EXTENDED HYDROPERIOD, SOMETIMES 2-3 YEARS OR MORE**

**THIS IS NOT NECESSARILY “GOOD”**

**LA NINA ... DROUGHT CONDITIONS AND PONDS DON'T FILL FOR  
MULTIPLE YEARS**

**THIS IS DEFINITELY NOT “GOOD”**

**Scott et al, SREL/SRS have documented a 7 day decrease in average  
Hydroperiod and an 8 day (later) change in average date of filling  
Since 1978, for Rainbow Bay, a Carolina bay at SRS that has been  
studied for 25+ years**







### ESTIMATED LIFE SPANS FOR SELECTED AMPHIBIANS:

**TIGER SALAMANDER – 15-20 YEARS**

**DWARF SIREN - 20+ YEARS**

**SPOTTED SALAMANDER – 20-30 YEARS**

**BULLFROG - 10-16 YEARS**

**GOPHER FROG – 6-7 YEARS?**

**FLATWOODS SALAMANDER – 4 YEARS?**







## **A SIMPLE POPULATION MODEL:**

**A BREEDING PAIR OF FROGS OR SALAMANDERS MUST REPLACE THEMSELVES ONCE IN A LIFETIME, ABSENT ANY MORTALITY IN THE POPULATION TO MAINTAIN A STABLE POPULATION ... ANYTHING MORE RESULTS IN AN INCREASING POPULATION, ANYTHING LESS A DECLINING POPULATION.**

**HYPOTHESIS: THE LIFE SPAN, AND POSSIBLY AGE TO FIRST REPRODUCTION FOR POND BREEDING AMPHIBIANS IS DETERMINED BY THE AVERAGE FREQUENCY OF INUNDATION OF THEIR BREEDING PONDS.**

**IN OTHER WORDS ... IF YOUR BREEDING POND(S) ONLY FILL ONCE EVERY 3-4 YEARS YOU BETTER LIVE AT LEAST 3-4 YEARS AND LONGER IS BETTER TO ACCOMMODATE VARIABILITY.**

**WHAT HAPPENS IF THE AVERAGE TIME BETWEEN INUNDATION INCREASES, ALONG WITH THE ALREADY DOCUMENTED REDUCTION IN HYDROPERIOD AND LATER DATE OF FILLING?**





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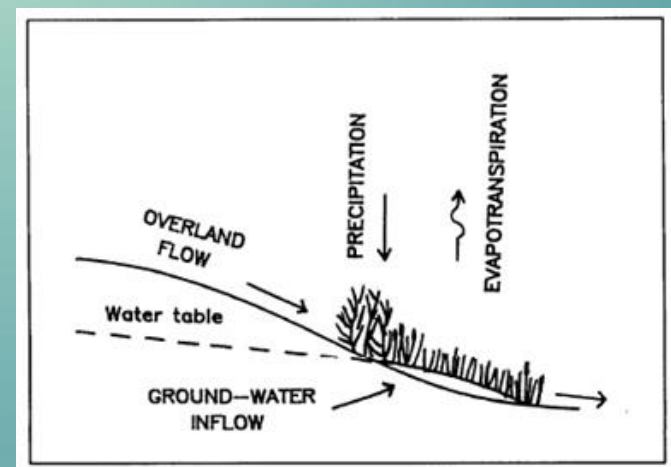
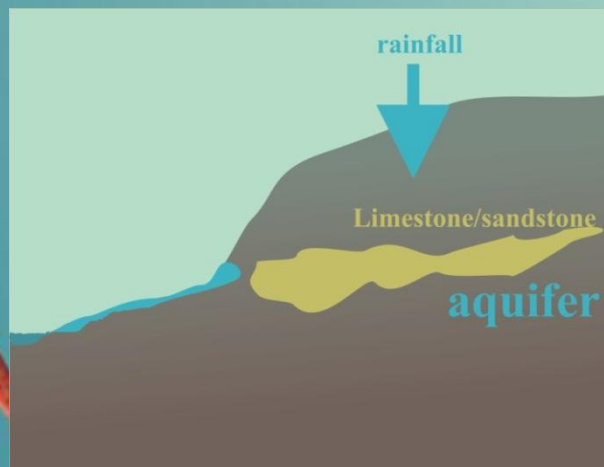
Source: EPA





## EXAMPLE 2 – SEEPAGE WETLANDS

SEEPS, BOGS, FENS SPRINGS, HEADWATERS ETC.







## SEEPAGE WETLAND CHARACTERISTICS

- TYPICALLY AT THE OUTER EDGE OF A STREAM CORRIDOR
- OCCUR AT OR NEAR THE BASE OF SLOPES AND BLUFFS
- PRIMARY WATER SOURCE IS EMERGING SUBSURFACE WATER
- PREDATORY FISH TYPICALLY ABSENT
- SALAMANDERS OF THE FAMILY PLETHODONTIDAE ARE THE
- DOMINANT VERTEBRATES
- VARIABLE IN SIZE ... WIDTH AND LENGTH OF STREAM AND WATER FLOW







**TWO-LINED SALAMANDER**



**THREE-LINED SALAMANDER**



**RED SALAMANDER**



**MANY-LINED SALAMANDER**



**"DUSKY" SALAMANDER**



**MUD SALAMANDER**



**CHAMBERLAIN'S DWARF SALAMANDER**



**FAMILY PLETHODONTIDAE  
"LUNGLESS SALAMANDERS"**







**PINE BARRENS TREEFROG**



**FIRE IS THE KEY**







If the region increases groundwater pumping to offset water shortfalls, then aquifers will be further depleted. In the long term, the depletion of ground water supplies would place additional strain on surface water resources. [\[3\]](#)

**RESULTS – SEEPS DRY UP AND CANNOT SUPPORT SALAMANDERS  
DRY CONDITIONS MAKE PRESCRIBED FIRE DIFFICULT  
AFFECTING AVAILABILITY OF BREEDING HABITAT FOR  
THE PINE BARRENS TREEFROG**



**Food Web Disruptions**

**Threshold Effects**

**Extinction Risks**





**AMPHIBIANS ARE FIRST RESPONDERS ... "CANARIES IN THE COAL MINE"  
WHEN IT COMES TO ANYTHING THAT CHANGES MOISTURE REGIMES,  
HYDROPERIODS OF TEMPORARY PONDS AND SEEPS**

**AMPHIBIANS COMPRISE A LARGE PERCENT OF THE STANDING BIOMASS  
IN MANY SYSTEMS ... THEY PLAY AN IMPORTANT ROLE IN FOOD WEBS**

**A NUMBER OF RARE AMPHIBIAN AND REPTILE SPECIES ARE DEPENDENT  
UPON TEMPORARY PONDS ... LOSS OF THIS HABITAT COULD LEAD TO  
EXTINCTIONS**

**CHANGES IN THE HYDROLOGIC CYCLES OF TEMPORARY PONDS AND  
SEEPS COULD BE DETRIMENTAL TO APPROXIMATELY 80% OF THE  
AMPHIBIAN SPECIES FOUND IN THE S.C. COASTAL PLAIN!**



